0.a. Goal

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

0.b. Target

Target 9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

0.c. Indicator

Indicator 9.4.1: CO_2 emission per unit of value added

0.d. Series

Indicator 9.4.1: Carbon dioxide emissions from fuel combustion (millions of tonnes)

Indicator 9.4.1: Carbon dioxide emissions per unit of GDP PPP (kilogrammes of CO_2 per constant 2017 United States dollars)

Indicator 9.4.1: Carbon dioxide emissions from manufacturing industries per unit of manufacturing value added (kilogrammes of CO_2 per constant 2015 United States dollars)

0.e. Metadata update

February 2021

0.g. International organisations(s) responsible for global monitoring

International Energy Agency (IEA)

United Nations Industrial Development Organization (UNIDO)

1.a. Organisation

International Energy Agency (IEA)

United Nations Industrial Development Organization (UNIDO)

2.a. Definition and concepts

Definitions:

Carbon dioxide (here after, CO_2) emissions per unit of value added is an indicator computed as ratio between CO_2 emissions from fuel combustion and the value added of associated economic activities. The indicator can be computed for the whole economy (total CO_2 emissions/GDP) or for specific sectors, notably the manufacturing sector (CO_2 emissions from manufacturing industries per manufacturing value added (MVA).

CO_2 emissions per unit of GDP are expressed in kilogrammes of CO_2 per unit of purchasing power parity GDP in constant 2017 USD. CO_2 emissions from manufacturing industries per unit of MVA are measured in kilogrammes of CO_2 equivalent per unit of MVA in constant 2015 USD.

Concepts:

Total CO_2 emissions for an economy are estimated based on energy consumption data for all sectors.

CO_2 emissions from manufacturing are based on energy data collected across the following subsectors (energy used for transport by industry is not included here but reported under transport):

- Iron and steel industry [ISIC Group 241 and Class 2431];
- Chemical and petrochemical industry [ISIC Divisions 20 and 21] excluding petrochemical feedstocks;
- Non-ferrous metals basic industries [ISIC Group 242 and Class 2432];
- Non-metallic minerals such as glass, ceramic, cement, etc. [ISIC Division 23];
- Transport equipment [ISIC Divisions 29 and 30];
- Machinery comprises fabricated metal products, machinery and equipment other than transport equipment [ISIC Divisions 25 to 28];
- Food and tobacco [ISIC Divisions 10 to 12];
- Paper, pulp and printing [ISIC Divisions 17 and 18];
- Wood and wood products (other than pulp and paper) [ISIC Division 16];
- Textile and leather [ISIC Divisions 13 to 15];
- Non-specified (any manufacturing industry not included above) [ISIC Divisions 22, 31 and 32].

Energy data are collected at a country level, based on internationally agreed standards (UN International Recommendations on Energy Statistics (IRES)). CO_2 emissions need to be estimated based on energy data and on internationally agreed methodologies (2006 IPCC Guidelines for National GHG Inventories).

The IEA collects national energy data, according to internationally agreed energy statistics definitions and estimates CO_2 emissions based on the 2006 IPCC Guidelines for National GHG Inventories' Tier 1 methodology, producing internationally comparable CO_2 emissions data for over 150 countries and regions.

The gross value added measures the contribution to the economy of each individual producer, industry or sector in a country. The gross value added generated by any unit engaged in production activity can be calculated as the residual of the units' total output less intermediate consumption, goods and services used up in the process of producing the output, or as the sum of the factor incomes generated by the production process (System of National Accounts 2008). Manufacturing refers to industries belonging to the sector C defined by International Standard Industrial Classification of All Economic Activities (ISIC) Revision 4, or D defined by ISIC Revision 3.

GDP represents the sum of gross value added from all institutional units resident in the economy. For the purpose on comparability over time and across countries, GDP based on purchasing power parity (PPP) is used to calculate the total CO_2 emissions intensity of the economy. MVA is estimated in terms of constant prices in USD. The current series are given at constant prices of 2015.

2.b. Unit of measure

CO_2 emissions from fuel combustion are reported in millions of tonnes.

CO_2 emissions per unit of GDP PPP are reported in kilogrammes of CO_2 per constant 2017 United States dollars.

CO_2 emissions from manufacturing industries per unit of MVA are reported in kilogrammes of CO_2 per constant 2015 United States dollars.

2.c. Classifications

UN International Recommendations for Energy Statistics (IRES)

2006 IPCC Guidelines for National Greenhouse Gas Inventories

International Standard Industrial Classification of all Economic Activities (ISIC) Revision 4

International Standard Industrial Classification of all Economic Activities (ISIC) Revision 3

3.a. Data sources

Data on total CO_2 emissions from fuel combustion, also disaggregated by sector, are taken from the International Energy Agency (IEA) CO_2 Emissions from Fuel Combustion database available at: (iea.org/reports/co2-emissions-from-fuel-combustion-2019).

The IEA produces the indicator on total CO_2 emissions/GDP, based on secondary sources for GDP (World Bank Development indicators and the National Accounts – Analysis of Main Aggregates (AMA)).

UNIDO maintains the MVA database. Figures for updates are obtained from national account estimates produced by UN Statistics Division (UNSD) and from national publications.

3.b. Data collection method

The IEA collects energy data at the national level according to harmonised international definitions and questionnaires, as described in the UN International Recommendations for Energy Statistics available at : (unstats.un.org/unsd/energy/ires/).

The estimates of CO_2 emissions from fuel combustion are calculated by the IEA based on the IEA energy data and the default methods and emission factors from the 2006 IPCC Guidelines for National GHG Inventories available at: (ipcc-nggip.iges.or.jp/public/2006gl/). More information on methodologies from the IEA is available at: wds.iea.org/wds/pdf/Worldco2_Documentation.pdf

The most recent GDP estimates published by the World Bank with reference year of 2017 have been used when calculating CO_2 emissions per unit of GDP indicator. Additionally, missing years for countries with at least one data point for GDP reported by the World Bank have been estimated using National Accounts – Analysis of Main Aggregates (AMA) growth rates.

For the calculation of the CO_2 emissions from manufacturing industries per unit of MVA indicator, the MVA and GDP country data are collected through a national accounts questionnaire (NAQ) sent by UNSD. More information on the methodology is available at:

unstats.un.org/unsd/snaama/methodology.pdf.

3.c. Data collection calendar

Data collection is carried out by receiving data electronically throughout the year.

3.d. Data release calendar

The IEA CO_2 emissions from fuel combustion statistics are published in February, April and July with progressively broader geographical coverage (publishing full information for two calendar years prior and selected information for one year prior).

UNIDO MVA database is updated between March and April every year.

3.e. Data providers

IEA, UNSD, UNIDO

Description:

NSOs and national energy data collecting agencies provide the data to UNSD and IEA.

3.f. Data compilers

Name:

UNIDO, IEA

Description:

IEA provides data on total CO_2 emissions, CO_2 emissions/GDP PPP and manufacturing CO_2 emissions.

UNIDO compiles the data using its source for MVA data and IEA for data on CO_2 emissions.

3.g. Institutional mandate

IEA as one of the custodian agencies responsible for monitoring progress towards the SDG 7.3 target, leverage on their national data efforts and add value by promoting coherent standards, definitions and methodologies for both raw data and the derived indicators with the ultimate goal of producing international comparable datasets.

UNIDO, as the specialized UN agency on industrial development, has the international mandate for collecting, producing and disseminating internationally comparable industrial statistics. UNIDO's mandate covers (i) the maintenance and updating of international industrial statistics databases; (ii) methodological and analytical products based on statistical research and experience of maintaining internationally comparable statistics; (iii) contributions to the development and implementation of international statistical standards and methodology; and (iv) technical cooperation services to countries in the field of industrial statistics. With the repositioning of UNIDO as the focal agency for inclusive and sustainable industrial development (ISID), its statistical mandate was expanded to cover all dimensions of industrial development, including its inclusiveness and environmental sustainability.

4.a. Rationale

The indicator CO_2 emissions per unit of value added represents the amount of emissions from fuel combustion produced by an economic activity, per unit of economic output. When computed for the whole economy, it combines effects of the average carbon intensity of the energy mix (linked to the shares of the various fossil fuels in the total); of the structure of an economy (linked to the relative weight of more or less energy-intensive sectors); of the average efficiency in the use of energy. When computed for the manufacturing sector (CO_2 emissions from fuel combustion per unit of manufacturing value added), it measures the carbon intensity of the manufacturing economic output, and its trends result from changes in the average carbon intensity of the energy mix used, the structure of the manufacturing sector, the energy efficiency of production technologies in each sub-sector and the economic value of the various output. Manufacturing industries are generally improving their emission intensity as countries move to higher levels of industrialization, but it should be noted that emission intensities can also be reduced through structural changes and product diversification in manufacturing.

CO_2 emission accounts for around 80% of all GHG emission from the manufacturing processes.

4.b. Comment and limitations

Estimation of CO_2 emission data is not systematized in many countries, although is performed internationally based on harmonised energy data collected at national level. Energy data collection is generally well established, although in some cases national methodologies may differ from internationally agreed methodologies. National data sources include statistical offices, energy ministries, environment agencies, among others. Energy consumption data and value added data are coming from different data sources which may raise some consistency issues.